OTHEC
372.3
059DE/S

54 Ont.

Ministry of Education
Ontario

DRAFT

Science Is Happening Here

A Policy Statement for Science in the Primary and Junior Divisions

Validation Copy

CURRICULUM RESOURCES
OISE LIBRARY
MAR 31 1987

Report or draft document for discussion purposes only.

The Honourable Sean Conway, Minister
Bernard J. Shapiro, Deputy Minister

THE LIBRARY

The Ontario Institute

for Studies in Education

Toronto, Canada

Ontario

Ministry
of
Education

Ministère
de
l'Éducation

(416) 965-8948 17th Floor
Mowat Block
Queen's Park
Toronto, Ontario
M7A 1L2

étage
Édifice Mowat
Queen's Park
Toronto (Ontario)
M7A 1L2

March 4, 1987

Ms. Ruth A. Marks
Librarian
Ontario Institute for
Studies in Education
252 Bloor Street W.
Toronto, Ontario
M5S 1V6

Dear Ms. Marks:

In accordance with initiative #1 in Science in Primary and Junior Education: A Statement of Direction, the Ministry of Education is developing a document outlining policy and direction for science in the Primary and Junior Divisions. This policy document will serve as a basis for the development of school board science programs and support materials.

The draft manuscript attached has resulted from the work of a representative Writing Team and Advisory Committee. As part of the development process, an opportunity is provided for validation ...for study of the draft material and for the provision of reaction and suggestions for improvement. The validation period will extend to June 30, 1987.

.../2

Ministry branches and regional offices, school boards and interested constituencies have been invited to participate in the validation process. This copy is provided for your information. Any questions or comments that you have may be directed to:

Centre for Early Childhood
and Elementary Education
17th Floor, Mowat Block
Queen's Park
Toronto, Ontario
M7A 1L2

Shannon A. Hogan
Director
Centre for Early Childhood
and Elementary Education

Enclosure

SCIENCE IS HAPPENING HERE

A Policy Statement for
Science in the Primary
and Junior Divisions

D R A F T

Validation Copy
March, 1987

Digitized by the Internet Archive
in 2025 with funding from
University of Toronto

https://archive.org/details/scienceishappeni00onta

SCIENCE IS HAPPENING HERE

PAGE	CONTENTS
1	INTRODUCTION
1	Ontario's Goals of Education
3	SCIENCE IN THE CURRICULUM
4	Rationale
5	THE IMAGE OF THE LEARNER
7	THE LEARNING ENVIRONMENT
8	Sex Equity
9	Special Needs
10	Multiculturalism
11	The Role of the Teacher
12	Grouping
13	Resources
14	The Computer
16	THE PROGRAM
16	SCIENCE IN A BALANCED AND INTEGRATED PROGRAM

19 Language
20 Attitudes
21 Skills
23 Knowledge
25 A Problem-Solving Model

28 THE PRIMARY PROGRAM

29 Life Science
31 Earth and Space Science
34 Physical Science

36 THE JUNIOR PROGRAM

38 Life Science
40 Earth and Space Science
42 Physical Science

45 ASSESSMENT AND EVALUATION

48 IMPLEMENTATION

48 The Ministry of Education
48 School Board Officials
49 Principals
50 Teachers

51 APPENDIXES

51 Appendix A: The Teacher's Role

53 Appendix B: Living Things in the Classroom

56 ACKNOWLEDGEMENTS

56 Project Managers

56 Project Leader

56 Writing Committee

56 Advisory Committee

INTRODUCTION

This document outlines the policy of the Ministry of Education for the development of the science component of the curriculum for the Primary and Junior Divisions. The policy described here supports and extends the aims for education in general and science in particular as outlined in the environmental studies section of The Formative Years.[1] The expectations outlined in Science is Happening Here: A Policy Statement for Science in the Primary and Junior Divisions must be used by school boards in developing local programs and support materials.

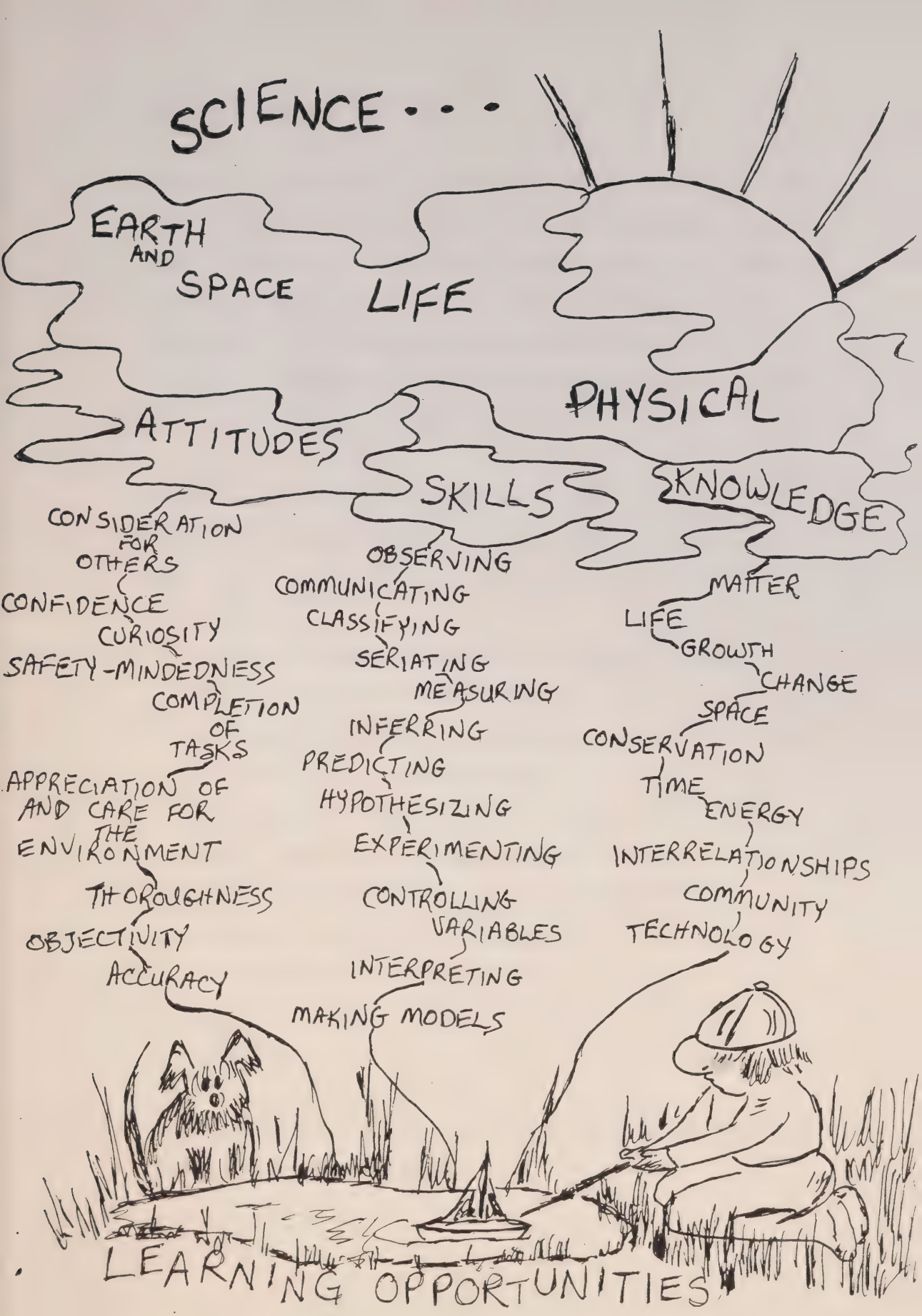
Ontario's Goals of Education

The Ministry of Education has the overall purpose of helping individual learners realize their potential in intellectual, social, emotional, moral, cultural, and physical development. The learning opportunities developed for science therefore should be consistent with the goals of education for the Province of Ontario which are to help each child:

---

1. Ministry of Education, Ontario, The Formative Years: Provincial Curriculum Policy for the Primary and Junior Divisions of the Public and Separate Schools of Ontario Toronto: Ministry of Education, Ontario, 1975), p. 22.

1. develop a responsiveness to the dynamic processes of learning;
2. develop resourcefulness, adaptability, and creativity in learning and living;
3. acquire the basic knowledge and skills needed to comprehend and express ideas through words, numbers, and other symbols;
4. develop physical fitness and good health;
5. gain satisfaction from participating and from sharing the participation of others in various forms of artistic expression;
6. develop a feeling of self-worth;
7. develop an understanding of the role of the individual within the family and the role of the family within society;
8. acquire skills that contribute to self-reliance in solving practical problems in everyday life;
9. develop a sense of personal responsibility in society at the local, national, and international levels;
10. develop esteem for the customs, cultures, and beliefs of a wide variety of societal groups;
11. acquire skills and attitudes that will lead to satisfaction and productivity in the world of work;
12. develop respect for the environment and a commitment to the wise use of resources;
13. develop values related to personal, ethical, or religious beliefs and to the common welfare of society.


SCIENCE . . .
EARTH AND SPACE
LIFE
PHYSICAL
ATTITUDES
SKILLS
KNOWLEDGE
CONSIDERATION FOR OTHERS
CONFIDENCE
CURIOSITY
SAFETY-MINDEDNESS
COMPLETION OF TASKS
APPRECIATION OF AND CARE FOR THE ENVIRONMENT
THOROUGHNESS
OBJECTIVITY
ACCURACY
OBSERVING
COMMUNICATING
CLASSIFYING
SERIATING
MEASURING
INFERRING
PREDICTING
HYPOTHESIZING
EXPERIMENTING
CONTROLLING VARIABLES
INTERPRETING
MAKING MODELS
MATTER
LIFE
GROWTH
CHANGE
SPACE
CONSERVATION
TIME
ENERGY
INTERRELATIONSHIPS
COMMUNITY
TECHNOLOGY
LEARNING OPPORTUNITIES

SCIENCE IN THE CURRICULUM

Science for children is a way of looking at the world that seeks to discover and explain order and patterns in what they observe and to apply that knowledge to solve problems and make further discoveries. Children bring to each experience a background of attitudes, skills, and knowledge. Through each learning opportunity these three areas are subject to change and growth.

Children learn about their physical and natural environment through science. This learning happens as they:

- explore, discover, investigate, and experiment;
- ask questions and seek answers;
- satisfy their curiosity about the many mysteries and wonders of their environment;
- seek applications of science in their environment;
- apply discoveries to create and invent;
- explore the technology in their environment;
- acquire confidence in their scientific ability through science experiences;
- relate science to their own needs and those of society.

For young children these elements of science learning are natural outcomes of play.

Children learn about technology when they see how the knowledge acquired through science experiences is applied in their lives and their environment. The use of simple tools and equipment is also an integral aspect of learning about technology. Through the attitudes, skills, and knowledge they acquire during science experiences, children begin to develop the ability to evaluate and make judgements about the use of various technologies.

Rationale

The children starting school in the 1990s will deal with the legacies of today's society and will be involved in fashioning tomorrow's world. It is our responsibility to provide science experiences that will encourage children to develop the skills, knowledge, and commitment they need to meet the challenges of the future.

Learning through and about science must be an active endeavour that allows and encourages children to explore their environment, ask questions, generate and test ideas, evaluate, and create. These skills are also life skills that will help children strengthen and deepen their reasoning abilities and become self-motivated, independent learners, and active and concerned participants in society.

The interest in and understanding of science and its applications through technology that the program seeks to develop will help children to:

- appreciate the beauty and value of the natural world;
- respond constructively to changes in the world brought about by science and technology;
- develop a favourable attitude towards the conservation of natural resources;
- develop the knowledge, skills, and attitudes required to make informed decisions about the uses of science and technology;
- enhance their self-concept through their investigations of the environment;
- appreciate the scientific and technological contributions of Canadians;
- see the relationship of science to other areas of learning;
- pursue scientific and technological studies;
- feel confident functioning in a society that makes use of science and technology.

THE IMAGE OF THE LEARNER

The Ministry of Education views the learner as "an active participant in education who gains satisfaction from the dynamics of learning" and as a "self-motivated, self-directed problem-solver aware of both the processes

and uses of learning and deriving a sense of self-worth and confidence from a variety of accomplishments."[2]

This learner is one who strives to:

- experience success in his/her terms;
- obtain approval from others;
- explore and take risks;
- initiate activities;
- develop reasoning ability and a capacity for creative thought;
- learn about science while playing, working, and exploring with others;
- understand that science can have a role in all areas of life;
- assess his/her progress;
- plan future directions;
- make sense of his/her environment through asking questions and seeking answers.

The image of the learner shapes the goals of education and the objectives of the program. Through direct observation, hands-on activities, and inquiry, children

---

2. Ministry of Education and Ministry of Colleges and Universities, Ontario, Issues and Directions (Toronto: Ministry of Education and Ministry of Colleges and Universities, Ontario, 1980), p. 2.

develop the skills that will help them become the active learners envisaged in the ministry's image of the learner.

While this image applies to all learners it is also important to acknowledge that considerations of sex equity, special learning needs, and varied backgrounds may affect children's interest and involvement in science studies. These considerations are discussed more fully below.

THE LEARNING ENVIRONMENT

The young learner's environment needs to reflect the image of the learner as an active, enthusiastic, and unique participant in the learning process.

The ideal environment for promoting active learning in science is carefully designed to be inviting to children. It is one that:

- offers children opportunities for direct observation and hands-on experiences with concrete materials;
- contains a variety of appropriate and current motivating materials;
- reflects the interests and needs of both the children and the teacher;
- encourages safe practices;
- accommodates both teacher-selected and child-initiated learning experiences;

- meets the changing needs and interests of children;
- gives children time and opportunities to explore freely, to reflect, and to consolidate learning;
- allows the teacher to capitalize on incidental events that occur spontaneously in the course of an activity;
- provides scope for individual differences and a variety of learning styles.

Sex Equity

Some children's early loss of interest in science may result from a variety of socializing factors that work against their complete involvement in science classes. To help all children realize their full potential it is essential for both girls and boys to participate equally in science activities. A conscious effort needs to be made to involve all children in the full range of learning opportunities, roles, and activities in science (including such activities as recording, reporting, setting up experiments, using equipment, maintaining safety awareness, and tidying up work areas).

When teachers consciously demonstrate an interest and involvement in science, children also become involved and view themselves as capable and interested in science. Inviting women as well as men to share their science experiences with the class will help children view science as a field of interest and endeavour appropriate for both

In addition, teachers need to be familiar with Ministry of Education publications that contain suggested teaching strategies for children with various exceptionalities.[3]

Multiculturalism

The philosophy of multiculturalism should permeate the school's curriculum, policies, teaching methods, and materials. As well, the attitudes and expectations of the staff as expressed through interactions with children, parents, and the community should acknowledge and celebrate the various cultural, linguistic, racial, and religious backgrounds.

The concept of interrelationships, which is central to many aspects of science, is also embodied in an understanding of multiculturalism. Teachers who use the children's varied backgrounds to enrich the learning process for the whole class will be helping children to acquire an understanding that is basic to scientific inquiry.

---

3. Children With Physical Handicaps and Health Impairments (1978); Vision (1978) (being revised); Children With Communication Exceptionalities (1979); Children With Mild Intellectual Handicaps (1979); Children With Moderate and Severe Intellectual Handicaps; (1981); Children With Learning Disabilities (1987); Programming for the Gifted (1985); Behaviour. (1986)

The Role of the Teacher

The science component of the program will be most effective when investigations are encouraged in an atmosphere where teachers listen, observe, and help children progress without dictating a precise direction.

The teacher is a planner and a facilitator of the program. In some situations the teacher encourages free exploration of science materials and concepts; in other situations the teacher facilitates the learning process by supporting a child's discovery with further experiences; at other times the teacher carefully directs the learning process towards anticipated outcomes.

Children need to be assured that risk taking and unexpected outcomes are part of scientific exploration and an important part of the learning process. The teacher provides a sensitive supportive environment where children feel secure in their explorations.

Children are most willing to explore in a creative environment where the teacher shows a willingness to learn alongside the children and thus models inquiry as an active participant. Appendix A presents sample questions that can help teachers evaluate their own role in the teaching/learning environment.

Grouping

To ensure that the science program accommodates the broad range of children's interests, talents, and needs, teachers should provide for whole-class, group, and independent activities. Group work is particularly important to help children:

- develop sensitivity to the views and feelings of others;
- assume responsibility in directing their own or the group's learning;
- share their ideas, feelings, and achievements with their peers;
- consolidate their learning;
- gain experience in planning, organizing, making decisions, and solving problems as a member or leader of a team;
- experience a variety of ways of interacting with others through playing different roles in a group context;
- share materials;
- co-operate in ensuring each other's safety.

Either the teacher and/or the children may determine the basis for forming groups. At different times, friendship groups or shared interest or other groupings may be appropriate.

Resources

Resources are important to a science program. Children must have the opportunity to interact with materials, observe phenomena, and experience processes in their environment.

Materials that encourage manipulation should be selected. They must be durable and safe, appropriate to the learner and the activity or task, and in many instances should be available on a continuous basis. Unusual or unfamiliar materials can also enhance and extend learning. Where plants and animals are used in the learning environment teachers should attend to the considerations regarding living things in the classroom outlined in Appendix B.

It should be noted that class sets of materials are not necessary. Grouping children and having them work at different activities is one strategy that permits sharing and wise use of resources so that all children can have the necessary hands-on experiences.

The school library resource centre plays an integral part in building and providing print and non-print resources to support hands-on experiences. As well, resources from the community and/or the natural environment are an important

supplement. Whenever reasonable, the learning environment should extend beyond the classroom and the school.

Human resources can play an important role in the planning process and provide assistance in the learning environment. They include teachers, children, the principal, the teacher-librarian, school board resource staff, parents, and other community members with expertise related to the program.

The Computer

The computer is valuable in science education both as a teaching aid and as an object of study.

As a teaching aid, it is most useful in providing extensions of and support for the program. It should not be regarded as a primary means of delivering science education, or as a replacement for the direct investigation of natural and physical phenomena and hands-on experiences.

However, appropriate software can further science studies. For example, simulations of expensive or dangerous activities and unusual phenomena can help overcome restrictions of cost, time, accessibility, and safety.

It is valuable for children to become knowledgeable and creative in their use of computers as tools to:

- record, store, manage, analyse, and retrieve raw data;
- represent and report results of investigations and experiments;
- extend their thinking skills and creative abilities.

Teachers should make a conscious effort to ensure that all children have opportunities to investigate and work with computers during science activities. They should also strive to make full use of computer technology when individualizing instruction to meet the special needs of children.

The computer may also be studied - at a level appropriate for children - as an example of technology. Such a study can promote students' awareness of the role of technology in our society. The actual and potential impact of this particular technology on our society could also be considered.

THE PROGRAM

SCIENCE IN A BALANCED AND INTEGRATED PROGRAM

This document describes the science component of a balanced and integrated program with a focus on the ways in which "activities and content drawn from the fields of science and technology can easily and profitably be woven into that integrated whole called the curriculum."[4]

Teachers need to ensure that the objectives for the program, and the resulting program design, specifically consider questions of balance and integration.

A teacher planning a balanced program could be compared to a nutritionist planning a balanced diet. In a balanced diet, all the nutrients essential for health are included in quantities and at intervals appropriate to the body's needs. The nutritionist assesses the needs of an individual or group of individuals to determine how much of a particular food should be eaten and how often. The diet is usually flexible enough to provide the individual or group with opportunities for creative choice and experimentation within reasonable bounds.

---

4. Ministry of Education, Ontario, Science in Primary and Junior Education: A Statement of Direction, p. 1.

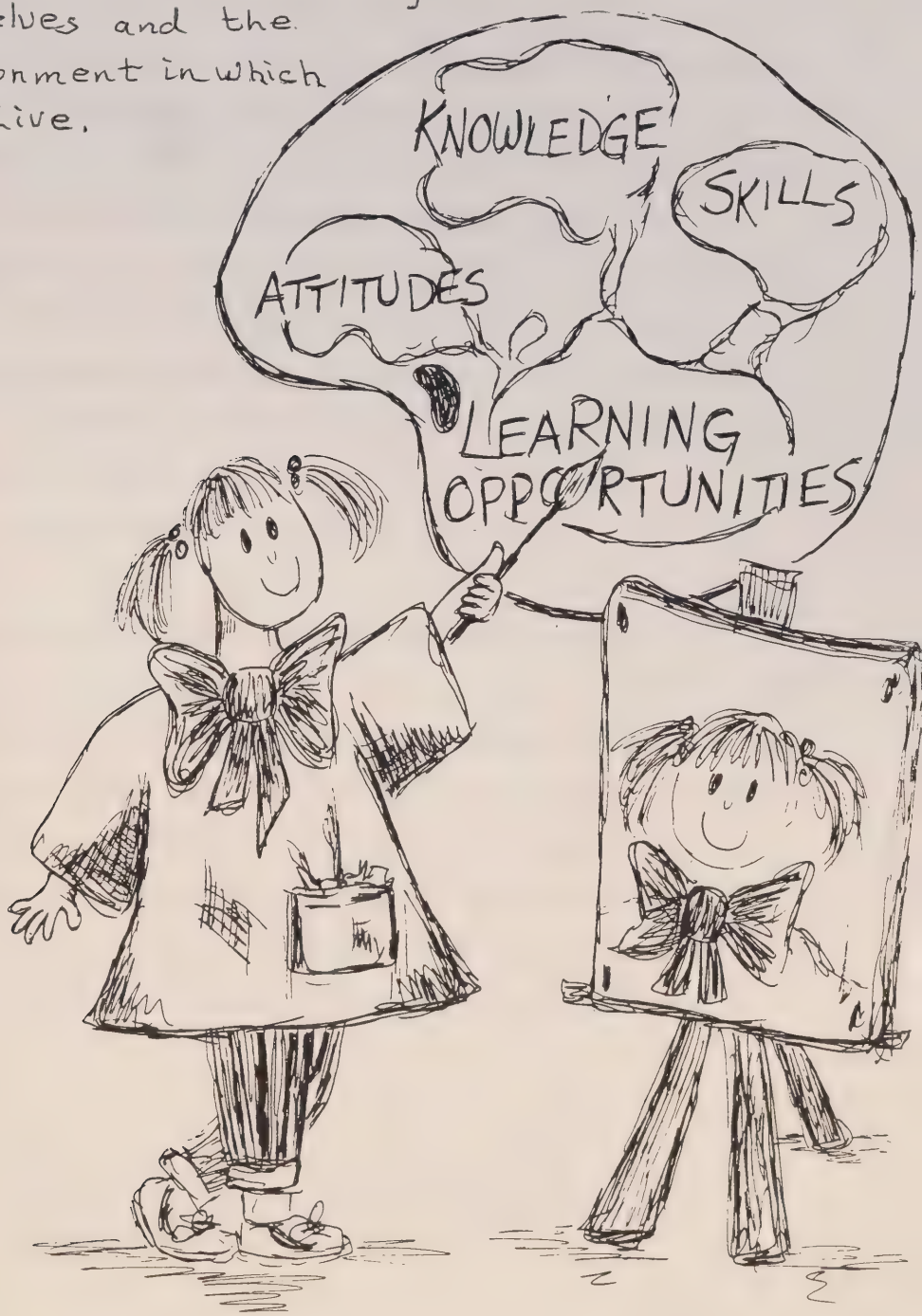
Similarly in education, while certain components are identified as essential parts of a balanced program, the teacher's professional assessment of the needs, abilities and interests of children will determine in what proportion and how often the various components are incorporated.

A balanced program will include the following components:

- learning experiences related to attitude, skill, and knowledge objectives;
- activities that cater to a range of abilities and learning styles;
- activities that are teacher initiated and directed and activities that are child initiated and directed;
- experiences for the whole class, small groups, and the individual child;
- divergent and convergent learning experiences;
- life science, earth science, physical science, and technological science;
- teacher, peer-group, and self-evaluation.

The notion of integration implies a curriculum "characterized by learning which is synthesized across traditional subject lines, and learning experiences which

Through the science learning opportunities in the program, children fashion an image of themselves and the environment in which they live.



are arranged in order to be mutually reinforcing."[5] An integrated program, then, is one in which the child has the opportunity to pursue learning in a holistic way without the restrictions imposed by subject-area boundaries. The challenge facing the teacher is to ensure that an integrated activity - one leading to learning in several curriculum areas - does so in a way that is truly relevant to each of those areas. For example, it is not regarded as science when children are given specific instructions for the mixing of primary colours to produce other colours. However, an art activity in which a student experiments with mixing the primary colours in order to discover which combinations produce other desired colours could be regarded as an activity that is science-oriented as well as art-oriented.

While integration of the total program is often appropriate, teachers have other options. Blocks of time may be provided in which science learning develops in a curriculum area such as environmental studies. In some instances the teacher's judgement may suggest the designing of learning experiences which focus primarily on science. To extend the latter two approaches, teachers may use something from science to enhance learning in

---

5. Ministry of Education, Ontario, "Education in the Junior Division: A Look at Forty-two Schools," Provincial Review Report No. 5 (1985) (Toronto: Ministry of Education, Ontario, 1985), p. 5.

another curriculum area (i.e., with a focus on correlation).

Language

Children develop, consolidate, and extend their receptive and expressive communication skills during science experiences.

Children's direct observation of and interaction with concrete materials can encourage discussion and develop the skills of classifying and ordering that lead to naming, describing, sequencing, charting, graphing, and the use of qualitative and quantitative words.

Science initiatives that involve the direct observation and exploration of sound can dramatically enhance children's listening skills. Learning opportunities that encourage children to talk about science observations and discoveries in their own words, as well as in scientific language, require a variety of expressive language skills. Children develop language in order to ask questions, describe, explain, clarify, and present conclusions about what they have experienced.

Attitudes

Children's attitudes affect their involvement in science activities and grow and change through these activities. While individuals develop personal attitudes about themselves and their environment, there are also generally accepted societal attitudes that are appropriate to science. By modelling these attitudes, teachers can encourage children to apply the knowledge and skills of science in responsible and positive ways.

The learning opportunities provided for science should help children to develop:

- their natural curiosity
- an appreciation and concern for the environment and living things;
- a willingness to frame and ask questions;
- a willingness to predict;
- a willingness to consider the feelings and opinions of others;
- a sense of responsibility in completing tasks;
- a willingness to formulate and test hypotheses based on their observations;
- objectivity in challenging ideas, hypotheses, and conclusions;
- a desire for accuracy and thoroughness in searching for evidence;

- a responsible attitude with regard to safety.

Skills

The skills children learn to gather and apply information are important to the learning process in all areas of the curriculum and are essential to science. By using these skills in reasoned and intuitive ways children make sense of their experiences and of the world around them. The skills involved in manipulating concrete materials, observing, classifying, seriating, measuring, inferring, predicting, hypothesizing, experimenting, controlling variables, interpreting, communicating, and making models are an integral part of doing science. While all of these skills may be used by children throughout the Primary and Junior Divisions, the more complex skills of interpreting, hypothesizing, experimenting, controlling variables, and making models are most appropriately developed in the Junior Division and beyond.

The skills developed through science are described below:

Observing - using the senses to gather information through personal experience;
Classifying - sorting objects, events, or conditions according to a pattern or a scheme devised by the observer;

Seriating - ordering objects, events, or conditions (e.g., shortest to longest, lightest to heaviest);
Communicating - receiving and expressing information through listening, speaking, writing, reading, viewing, and presenting;
Measuring - using both arbitrary units (e.g., hand spans, paces) and standard units (e.g, minute, metre, kilogram, degrees Celsius) to develop quantitative descriptions;
Inferring - making assumptions about an attribute that has not been directly observed;
Predicting - using information to make decisions about what may happen in the future;
Hypothesizing - advancing a possible explanation based on a number of observations;
Experimenting - designing and carrying out investigations to test predictions or hypotheses;
Controlling Variables - discovering and manipulating conditions that affect the results of an experiment;
Interpreting - developing conclusions about information gathered;
Making Models - developing models to describe the behaviour of things that are inaccessible in terms of things that are readily available (e.g., a paper airplane).

Children also need to develop the physical skills involved in using equipment appropriate to their science explorations and activities.

Knowledge

As children acquire information they build concepts and make generalizations. The knowledge gained through one learning experience affects other endeavours, provides children with a base from which to acquire new knowledge and skills, and gives them the confidence to seek answers to new questions.

While the choice of appropriate learning opportunities for children in the Primary and Junior Divisions is based upon general concepts, it is important for the experiences to grow from the perspective of the children rather than from the abstract concept itself. That is, opportunities involving heat, electricity, or magnetism will contribute to a growing concept of energy without specifically defining "energy".

The learning opportunities provided for science must help children to develop:

- knowledge about the nature of science, including an awareness of:

  - the various skills (e.g., observing, which includes using the five senses)

- the equipment appropriate to science activities (e.g., magnifiers, which enable us to extend our sense of sight)
- the vocabulary and terminology that relate naturally to first-hand science experiences
- safety procedures and equipment
- the role of the various processes in scientific problem solving
- the potential and limitations of science

- knowledge about themselves and their immediate environment that will enhance their growth in understanding of the following concepts:

- energy
- space
- time
- matter
- community
- life
- change
- growth
- interrelationships
- technology
- conservation

A Problem-Solving Model[6]

There are many contexts in which the methods of science inquiry are used. One of them is problem solving. In problem solving, attitudes, skills, and knowledge play an integrated role in helping to answer questions and solve problems. A problem-solving model might include:

Exploring. Children learn by using their senses to explore materials and events. As they do so, they identify interests and formulate questions.

Inquiring. Children ask questions of themselves and others to clarify an issue or define a problem related to their interests.

Predicting. Children think of a range of reasonable possibilities in order to answer a question.

Planning and Collecting. Through planned activities children gather information about each predicted possibility. One way of collecting information is through designing and carrying out experiments.

Deciding. Children decide, on the basis of the information they have gathered, which is the best answer to a question.

---

6. The material in this section is adapted from: Ministry of Education, Ontario, Shared Discovery: Teaching and Learning in the Primary Years (Toronto: Ministry of Education, 1985), pp. 9-10.

Communicating. Children choose the best way to present their findings. (Making this decision involves another cycle of problem solving.)

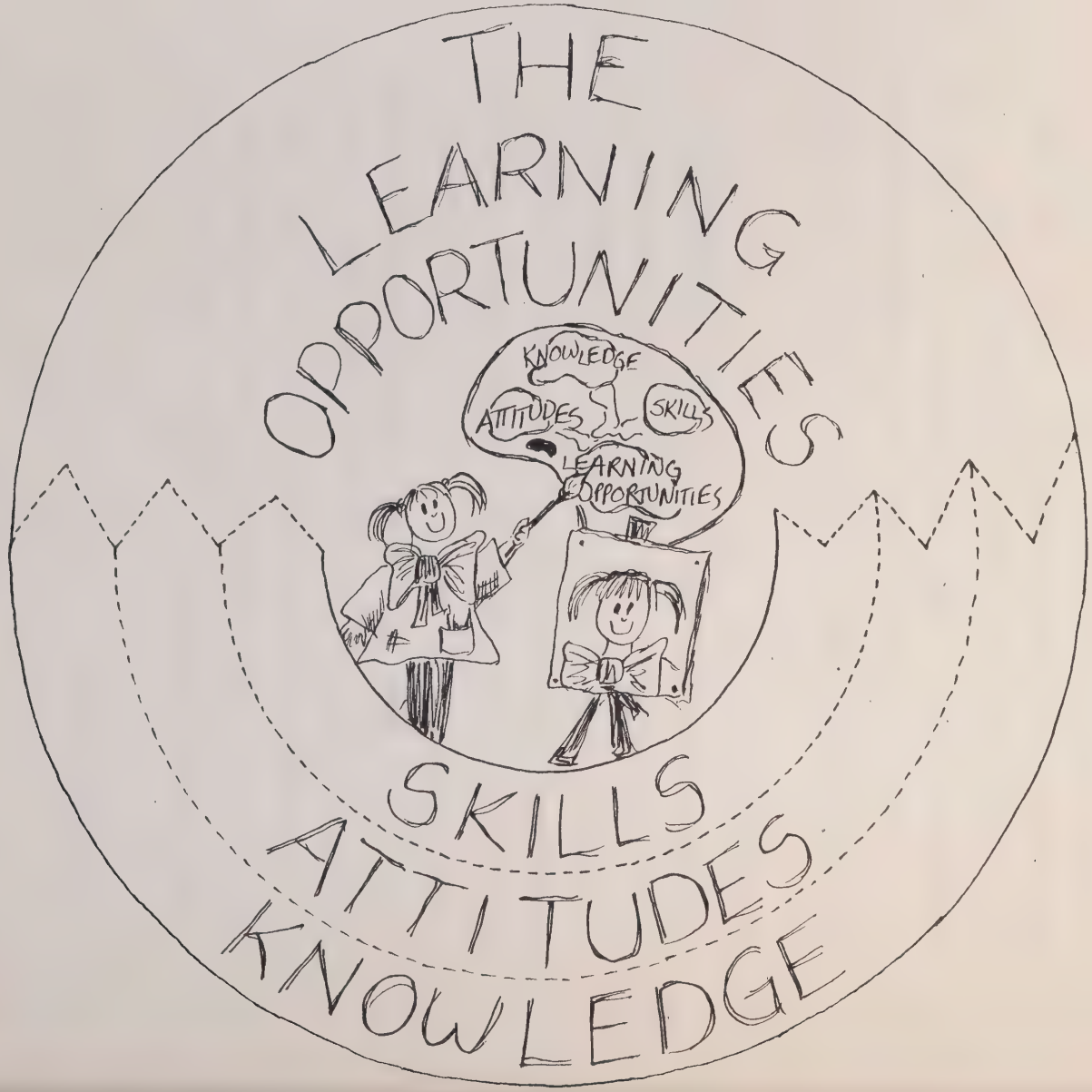
Evaluating. Children check the merits of their conclusions and the effectiveness of their problem-solving techniques. (Evaluation by the children should occur throughout the sequence as well as at the end.)

Applying. Children seek examples from their own experience of what they have learned.

The components of problem solving are presented here in linear fashion. Real-life problem solving often approximates this model, but, as children move through the stages in the sequence, ongoing evaluation may suggest the need to retrace steps and repeat some or all of the preceding stages. This may be done to clarify the problem further in order to proceed to the next stage.

Note to Validators

Learning opportunities are arranged here in linear fashion. Technology-related opportunities are presently identified by an asterisk, but in the published document a different format may be used to identify them. Ways of presenting the primary and junior learning opportunities in relation to one another may also be different. Validators are invited to make suggestions for the type of format that may be most appropriate.



THE CHILD BRINGS TO EACH EXPERIENCE A BACKGROUND OF KNOWLEDGE, SKILLS, AND ATTITUDES. THROUGH EACH LEARNING OPPORTUNITY THESE THREE AREAS ARE SUBJECT TO CHANGE AND GROWTH.

THE PRIMARY PROGRAM

Every learning experience incorporates the acquisition of knowledge with the development of skills and attitudes. It is important for children to process each new learning experience so that it becomes part of the understanding they already have. The learning opportunities identified for the primary program should help children to develop appropriate attitudes, skills, and knowledge. It is the professional responsibility of the teacher "to ensure learning at a level and rate that are in keeping with individual abilities".[7] A resource teachers might use in fulfilling this responsibility is The Complexities of Childhood chart.[8]

Among the learning opportunities listed below, the ones identified by an asterisk, are those in which children may become specifically aware of applications of science and technology. For young children the purpose is to encourage an awareness rather than a detailed knowledge of specific technologies.

---

7. Ministry of Education, Ontario, The Formative Years, p. 5.

8. Ministry of Education, Ontario, The Complexities of Childhood (Toronto: Ministry of Education, n.d.).

BY THE END OF THE PRIMARY DIVISION CHILDREN SHALL HAVE HAD OPPORTUNITIES TO:

Life Science

- demonstrate concern and care for the environment (e.g., by maintaining bird feeders, planting bulbs, using litter receptacles);

*- become aware of some of the machines and tools that are used in maintaining a safe, clean environment (e.g., garbage truck, broom, street sweeper, rake, furnace filter);

- observe and describe a wide variety of common living things in the classroom, the neighbourhood, and the natural environment;

*- identify ways in which natural materials and substances are used by people (e.g., wood for wooden blocks, wool and cotton for clothing);

*- extend their senses by using such devices as binoculars and magnifiers;

- observe the growth and development of common animals and common plants;

*- become aware of equipment that aids in making observations (e.g., binoculars, paper-towel tube, bird feeder, glass-bottomed boat);

- explore ways by which living things adapt to their natural environment in order to survive (e.g., hibernation, camouflage);

- care for an animal and a plant over an extended period of time;

*- use materials to help reproduce a natural environment (e.g., aquarium, terrarium, ant farm, planter, incubator, greenhouse);

- explore the needs of animals and plants and how they are met (e.g., water, food, shelter, light, air, rest, physical activity);

- explore the similarities and differences among living things (e.g., body parts, mobility, coverings);

*- identify devices that imitate animal characteristics (e.g., snowshoes, swimming flippers);

- observe ways in which animals behave and interact;

- investigate a variety of plant and animal products (e.g., fish, fruit and vegetables, grain, beef, dairy products, lumber, paper);

*- become aware of some of the machines that are used in the cultivation, harvesting, processing, storing or transportation of plant and animal products (e.g., garden fork, tractor, milking machine, chain saw);

- explore the role of the human senses in gathering information;

*- become aware of equipment that extends or assists our senses (e.g., eyeglasses, hearing-aid, smoke detector, stethoscope);

- develop an awareness of the human body and its needs;

*- become aware of tools and instruments people use to assist them in health care and nutrition (e.g., tooth brush, medical thermometer);

- consolidate learning through oral and written communication;

- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);

*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);

- develop concern for their own safety and the safety of others;

*- develop safe practices in relation to the equipment used during science experiences;

Earth and Space Science

- play with water using water toys (e.g., funnel, siphon, water wheel);

- discover through play some of the properties of water (e.g., takes the shape of any container, freezes);

*- experience some ways in which mechanical devices are designed to accommodate and use the properties of water (e.g. water pump, garden hose, sink overflow hole, siphon, plant mister, water wheel);

- explore the phenomena of sinking, floating, absorbing, dissolving, etc., with a variety of common materials (e.g., sponge, boat, anchor, wax paper);
- discover through play with water simple concepts related to pressure, displacement, movement, and propulsion;
- discover through play some of the functions of water (e.g., for sustaining life, for cooling, for transporting, for cleaning);
- discover some of the properties of wet and dry sand;
*- explore some of the uses of sand (e.g., concrete, sand timer, sand castles);
- observe and describe weather conditions (e.g., snow, rain);
*- become aware of the ways in which different tools help us make observations about the weather (e.g., a thermometer, a rain gauge, a weather vane);
- observe that weather generally follows annual patterns and that these patterns can be classified according to seasons;
*- become aware of materials and tools people use to adapt to different weather conditions (e.g., toboggan, water-repellent materials, insulation, fans);
- observe and describe a variety of indicators of seasonal change;
- recognize that certain observations in the environment may be used to predict change (e.g., buds precede leaves and flowers);

*- become aware of devices used to record observed events in science (e.g., camera, tape recorder);

*- become aware of devices used to record predictable events in their lives (e.g., calendars, school bells);

- experience activities that encompass both long and short intervals of time;

*- use a variety of devices to establish arbitrary units of time (e.g., a metronome, a dripping tap, a pendulum);

*- construct a device to measure arbitrary units of time (e.g., a water clock, a sand clock, a pendulum);

- identify predictable events in their lives (e.g., birthdays, holidays);

- develop time lines to track and record observed events in science (e.g., plant growth, changes of state, their own life patterns);

- observe and describe the changes in the pattern of a shadow as it relates to the sun;

*- become aware of devices used to record the apparent movement of the sun (e.g., a flag pole, a post, a simple sundial);

- develop an awareness of the movement of the earth that results in day and night;

- make simple observations about the sun, moon, earth, and stars in space;

*- develop an awareness of the devices people use to learn about the moon and other bodies in outer space (e.g., telescope, rocket, space shuttle);

- consolidate learning through oral and written communication;
- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);
*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);
- develop concern for their own safety and the safety of others;
*- develop safe practices in relation to the equipment used during science experiences;

Physical Science

- observe and describe a variety of materials (e.g., plastic, wood, paper, rubber);
- classify, seriate, and experiment with common materials on the basis of their own criteria;
- classify and seriate common materials on the basis of established criteria (e.g., texture, size, mass, flexibility, volume, odour, colour, hardness);
*- use appropriate devices to make arbitrary and standard measurements (e.g., balance, metre stick, pop can);
- explore and experiment with ways to move objects by pushing and pulling;

*- identify devices that illustrate the use of pushes and pulls to move objects (e.g., spinning top, door);

- investigate friction;

- become aware of devices used to affect friction (e.g., sandpaper, toothpaste, grease, velcro);

- use appropriate concrete materials to explore three or more types of energy (e.g., light, sound, electricity, magnetism, heat, mechanical energy);

*- experiment with some devices that make use of properties of different types of energy (e.g., mirror, prism, kaleidoscope, musical instruments, megaphone, wind-up toys);

- observe evidence of energy in the immediate environment (e.g., toy cars moving, kites flying, pinwheels whirling, lighbulbs giving off heat, magnets moving objects);

*- identify devices and machines that use different types of energy (e.g., cars, toasters, windmills, flashlights, wind-up toys);

- develop awareness of their dependence on energy;

- develop awareness of their role in the wise use of energy;

*- identify devices that may help conserve energy (e.g., light switch, thermostat, doors and windows, insulation, tap);

- observe and describe simple changes of state (e.g., snow to water, water to ice, water to steam);

*- become aware of machines that produce changes of state similar to those that occur in nature (e.g., steam iron, vaporizer, freezer, clothes dryer);

- experiment with the interaction of various materials (e.g., by cooking things, freezing things, applying adhesive materials, mixing things);

- consolidate learning through oral and written communication;

- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);

*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);

- develop concern for their own safety and the safety of others;

*- develop safe practices in relation to the equipment used during science experiences;

THE JUNIOR PROGRAM

Every learning experience incorporates the acquisition of knowledge with the development of skills and attitudes. It is important for children to process each new learning experience so that it becomes part of the understanding they already have. The learning opportunities listed here describe the kinds of experiences children will have

rather than specific learning outcomes. The wording of these opportunities does not always indicate obvious growth from the Primary Division. In such instances it should be understood that growth will be embodied in the child's response to the activity. It is the professional responsibility of the classroom teacher "to ensure learning at a level and rate that are in keeping with individual abilities".[9] A resource teachers might use in fulfilling this responsibility is The Complexities of Childhood chart.[10]

Among the learning opportunities listed below, the ones identified by an asterisk, are those in which children may become specifically aware of applications of science and technology. For young children the purpose is to encourage an awareness rather than a detailed knowledge of specific technologies.

BY THE END OF THE JUNIOR DIVISION CHILDREN SHALL HAVE HAD OPPORTUNITIES TO:

---

9. Ministry of Education, Ontario, The Formative Years, p. 5.

10. Ministry of Education, Ontario, The Complexities of Childhood (Toronto: Ministry of Education, n.d.).

Life Science

- demonstrate concern and care for the environment (e.g., by planning and conducting a school yard beautification project, assuming responsibility for the care of classroom plants or animals);

*- identify ways to care for the environment (e.g., recycled materials, sewage treatment plants, sewers, reusable containers);

- observe, describe, and compare a wide variety of common plants and animals in the immediate environment;

*- use equipment to observe plants and animals (e.g., magnifier, low powered (40x)microscope);

- observe and describe plants and animals peculiar to a particular habitat (e.g., pond, woodlot, schoolyard, forest);

- observe the ongoing process of change in a natural community;

*- use equipment to record the ongoing process of change in a natural community (e.g., recorder, camera);

- investigate the life cycles of some common plants and animals;

*- use materials to replicate a natural environment (e.g., aquarium, greenhouse, ecosystem, hydroponic garden);

- design and perform an experiment in relation to seed germination or plant growth;

- develop their own simple systems for classifying plants and animals;

- identify interrelationships among living things (e.g., simple food chains, territorial behaviour, parasites);

*- investigate ways in which people affect plant and animal life (e.g., using fertilizers or pesticides, developing a subdivision, establishing a wildlife preserve);

- investigate human dependence on plants and animals (e.g., food, clothing, oils, building materials);

*- identify and describe several machines used in the cultivation, processing, harvesting, storing or transportation of plant or animal products (e.g., farming or lumbering equipment);

- develop an awareness of the human body, its needs, systems, and functions;

*- identify devices used to investigate the needs, systems, and functions of the human body (e.g., stethoscope, x-ray machine);

- consolidate learning through oral and written communication;

- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);

*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);

- develop concern for their own safety and the safety of others;

*- develop safe practices in relation to the equipment used during science experiences;

Earth and Space Science

- design and conduct experiments involving the properties and functions of particles (e.g., sand, sugar, salt) and liquids (e.g., water, oil, vinegar);
- investigate one of the following from the local environment: rocks and minerals, fossils, soils;
*- identify one or more devices people employ to investigate rocks and minerals, fossils, or soils (e.g., rock tumbler, hand lens, sieve);
- observe and describe a variety of weather conditions (e.g., snow, rain, fog, thunder, lightning, hail);
- suggest ways of predicting weather changes;
*- identify devices used to describe and predict weather conditions (e.g., barometer, anemometer);
*- design and construct simple weather instruments (e.g., wind vane, rain gauge, anemometer, barometer, hygrometer);
- identify ways weather conditions affect their lives;
*- become aware of devices used to adapt to different weather conditions (e.g., foghorn, lightning rod, snowplow);
*- use appropriate materials to explore the nature and movement of air (e.g., pinwheel, fan, kite);
- estimate and measure time to the nearest hour, minute, and second;

*- design, construct, and calibrate a device to measure units of time (e.g., sand clock, water clock, pendulum);

- become aware of the application of various units of time (e.g., vacations measured in weeks or days, 100 m dash measured in hundreths of a second);

*- identify devices for measuring particular units of time (e.g., stopwatch, clock, watch, calendar);

- identify cyclical occurrences in their lives and in the natural world (e.g., phases of the moon, activity/rest cycles, growth rings in a tree);

- develop time lines to track and record observed events of a scientific nature (e.g., changes of state, plant growth, experimental processes);

*- identify and use devices for tracking and recording scientific events (e.g., tape recorder, camera, calendar);

- estimate and measure distances and the time that objects take to travel those distances (rate);

- use time as a variable in an experiment;

- develop an awareness of the movement of the earth that results in seasons;

- develop an awareness of the earth, moon, and sun and phenomena such as eclipses and phases;

- develop an awareness of problems related to travel in space (e.g., life support, movement);

*- become aware of devices people use to deal with special problems of space travel (e.g., freeze-dried food, pressurized ballpoint pens);

- consolidate learning through oral and written communication;
- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);
*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);
- develop concern for their own safety and the safety of others;
*- develop safe practices in relation to the equipment used during science experiences;

Physical Science

- design and perform an experiment to compare two or more materials in relation to a particular property (e.g., strength of plastic garbage bags);
- investigate the physical properties of one or more materials (e.g., absorbency of paper towels, expansion of solids, solubility);
- explore and experiment with ways in which a material can be changed naturally (e.g., by rust, decay);
*- identify products and processes used to preserve materials (e.g., rust inhibitors, paint, drying, galvanizing, freezing);

*- use appropriate devices to make arbitrary and standard measurements (e.g., balance, metre stick, pop can, spring scale);

*- design, construct, and calibrate a measuring device (e.g., thermometer, balance, force meter);

*- construct and experiment with devices incorporating one or more simple machines: lever, pulley, wheel and axle, inclined plane, wedge, screw;

- design and perform an experiment to explore a cause-and-effect relationship (e.g., factors that affect the rate at which a pendulum swings);

*- identify everyday devices that incorporate simple machines (e.g., scissors, teeter-totter, block and tackle, crane, ramp, jar lid, manual pencil sharpener);

*-observe and classify devices in terms of the forms of energy the devices use and produce;

- use appropriate concrete materials to explore the characteristics and properties of energy in one or more of its forms (e.g., to experiment with: electrical circuits or static electricity; sound; light; magnets and electromagnets; heat; mechanical objects; chemical substances);

*- identify devices or substances that show the uses of different types of energy (e.g., <u>electrical</u> - blender, toaster, stoplights, Christmas tree lights; <u>sound</u> - bells, buzzers, musical instruments; <u>light</u> - mirror, eyeglasses, prism; <u>magnetic</u> - refrigerator door, crane lift; <u>heat</u> - school furnace, solar cooker; <u>mechanical</u> - wind-up toys,

manual can opener, bicycles; chemical - rock salt, baking ingredients, household solvents);

- explore the transfer of energy from one form to another (e.g., electrical to heat);

*- identify materials or objects in which the transfer of energy occurs (e.g., solid fuel, kettle);

- develop awareness of renewable and non-renewable forms of energy;

*- identify devices that provide energy from renewable sources (e.g., windmill, solar panel);

- demonstrate concern and care for the environment (e.g., repair dripping faucet, recycle paper);

- develop an awareness of their role in the wise use of energy;

*- identify devices used to conserve energy (e.g., time switch, tap, showerhead flow restrictor, thermostat);

- observe the natural change of a variety of substances and objects over a period of time and predict future change (e.g., solid room deodorizers, crystals in solution);

- consolidate learning through oral and written communication;

- develop and use a variety of techniques for recording, reporting, and representing experiences with science (e.g., discussion, pictures, charts, graphs, drama, stories, models, newsletters);

*- use a variety of technologies for communication related to experiences with science (e.g., computer, typewriter, television, camera);

- develop concern for their own safety and the safety of others;

*- develop safe practices in relation to the equipment used during science experiences;

ASSESSMENT AND EVALUATION

In the science program a central objective is to encourage children to become active learners, motivated to explore the world around them from a science perspective. Because the emphasis in the program is on providing children with hands-on experience and encouraging direct observation of phenomena, teachers must address the development of the child's attitudes and skills as well as knowledge.

Direct observation of children's activities and the products of those activities is a particularly valuable assessment tool to assist teachers in gathering information and making judgements about how children:

- perform specific tasks;
- respond to unstructured assignments;
- operate in a group;
- approach a project that requires them to initiate activity, gather information, and report;

- use skills (e.g., observing, classifying) in science-related activities.

Ongoing observation of children's day-to-day activities provides immediate feedback. Observation of the products of those activities gives teachers a long-term view of children's development, provides concrete evidence of their progress, and is useful in reporting to parents.

It is appropriate to design an activity that requires children to demonstrate a skill or understanding by manipulating real objects. Assessment may also be based upon oral or written responses.

The Ontario Assessment Instrument Pool (OAIP) will provide teachers in the Junior Division with a range of sample assessment items.

By maintaining a record of assessment information teachers are able to determine children's needs, assess program effectiveness, and prepare meaningful reports for children and parents. Methods of recording include: rating scales, charts and graphs, individual and group profiles, anecdotal comments, forms for peer and self-evaluation, and check lists.

Assessment by the teacher provides information required to evaluate the effectiveness of the program and the suitability of materials to the program and to the needs and abilities of the children. This information is necessary for effective planning by the teacher. Asssessment by the teacher is also used to measure children's growth in skills, knowledge, and attitudes, and to provide information to the children, the parents, and the teacher.

Self-assessment by individual children helps them develop a sense of responsibility for their own learning. It encourages children to reflect on their growth and learning, giving them a sense of where they've been, where they are, and where they are going. As well, it helps them develop and practise self-assessment techniques.

Children provide feedback for one another either incidentally or through a planned process. Assessment by peers provides the children with other responses to their work besides those of the teacher and helps them appreciate the roles of the various individuals in a group setting.

IMPLEMENTATION

The Ministry of Education, school board officials, principals, and teachers jointly share the responsibility for meeting the expectations for science curriculum outlined in this policy statement. All participants have a responsibility to:

1. familiarize themselves with the policy and direction outlined in this document;
2. foster professional development and support in-service programs;
3. promote community awareness of the importance of the science component of the curriculum and involve community members in its implementation.

The Ministry of Education

The Ministry of Education has responsibility for developing curriculum policy, initiating the implementation process, and reviewing policy and implementation.

School Board Officials

The role of school board officials including supervisory officers and consultative staff is to provide:

- leadership in various aspects of the implementation process including curriculum and professional development;
- opportunities for co-operative planning;
- support materials based on the policy outlined in this document;
- resources and appropriate facilities for hands-on activities.

Principals

Principals participate in the implementation process by providing leadership, supporting initiatives and plans for highlighting the science component in a balanced and integrated program, and co-ordinating the efforts of staff members to implement the program at the school level.

They are responsible for:

- ensuring availability of resources, both of materials and of personnel;
- encouraging shared management of implementation so that all staff have input into and a sense of ownership of the process;
- analysing implementation and evaluating progress towards its objectives.

Teachers

Successful implementation depends on the teacher, who makes a commitment to translate policy into a plan of action in the classroom. The teacher's plan of action for program delivery should focus on:

- co-operating with other staff members to plan and carry out implementation within policies developed by the local school board;
- enlisting the support of teacher-librarians for such things as planning, team teaching, and development of resource-based learning;[11]
- developing program objectives that incorporate science in a balanced way and that allow for integration of science with other curriculum areas;
- identifying necessary resources (people and materials) and taking action to make them available to the children;
- ensure program that is in keeping with children's needs;

---

11. See Ministry of Education, Ontario, Partners in Action: The Library Resource Centre in the School Curriculum (Toronto: Ministry of Education, 1982).

APPENDIXES

Appendix A: The Teacher's Role

Listed below are some questions teachers can ask themselves to evaluate their role in relation to the science component of the program.

1. In what ways are attitudes, skills, and knowledge being developed?
2. In what ways are children encouraged to identify and pursue their own questions and interests?
3. In what ways do I show respect and support for the children?
4. What strategies do I use to encourage children to investigate science in the out of doors?
5. In what ways do I participate along with children in experimentation and discovery?
6. What strategies do I use to make children familiar with the care and proper handling of living things?
7. In what ways do I model safe practices during science activities?
8. In what ways are expectations with regard to safe practices communicated to the children?
9. In what ways do I facilitate children working in a variety of group settings (e.g., individually and in small and large groups)?

10. In what ways do I encourage the children to observe, question, discuss, and experiment?
11. In what ways are children invited to use their senses to examine, manipulate, and interact with their environment?
12. In what ways do I provide opportunities for the children to process and consolidate their learning?
13. What strategies do I use to have the children record and report their observations and experiences?
14. In what ways do I incorporate appropriate resources into the learning environment?
15. What strategies do I use to maintain a flexible learning environment that will accommodate the needs and interests of all children?
16. What strategies do I use to ensure a safe learning environment in accordance with school board policy?
17. In what ways do I achieve a balance between child-initiated and teacher-initiated activities?
18. In what ways do I ensure that learning outcomes established for the children are appropriate?
19. In what ways are children encouraged to supply some of their own materials so that their interests are incorporated into the program?
20. In what ways are resource personnel involved in the program?
21. In what ways do I ensure that assessment and evaluation strategies reflect the other components of the learning environment?

Appendix B: Living Things in the Classroom[12]

Many learning opportunities are enhanced by the presence of living things. To ensure that the inclusion of living things in the classroom environment is a positive experience, teachers must follow related school-board policies and attend to the following requirements for the care of plants or animals:

- housing facilities provided for living things must ensure the safety and protection of both the children and the plants and animals;
- plans should include appropriate feeding schedules, provision for care on weekdays, weekends, and holidays, and strategies to accommodate possible offspring. They should also include strategies to be employed when the living things are no longer required;
- questions of hygiene, infectious diseases, allergies, bites, smells, etc., and ways of dealing with them should be discussed with principals, parents, and children.
- animals such as rats, hamsters, gerbils, guinea pigs, and fish are very useful, but should be purchased from accredited dealers who can supply disease-free stock;

---

12. The material in this section has been adapted from: Ministry of Education, Ontario, Science in the Primary and Junior Divisions, A Support Document to The Formative Years (Toronto: Ministry of Education, Ontario, 1983), p. 9-10.

- invertebrates such as snails, spiders, caterpillars, sow bugs, earthworms, or mealworms are also useful organisms to keep because:

° they are easily obtainable;
° they do not transmit disease;
° they can be returned to their habitat;
° they require less space and specialized equipment than vertebrates;

- wild vertebrates should not be brought into the schools;
- micro-organisms should be cultured only in sealed containers and never on agar or gelatin plates;
- children should be instructed never to put any plant material into their mouths. Many plants have poisonous or irritating parts; some fungi are dangerous;
- washing hands before as well as after handling animals and plants should be normal classroom procedure. Children should use polythene gloves, which are inexpensive and disposable, when cleaning cages;
- monkeys, wild mammals, turtles, or such birds as budgerigars and parrots should never be kept in the classroom because they can transfer dangerous diseases;
- newly hatched chickens and ducklings should not be kept in the classroom for long periods of time;
- teachers should be prepared to deal with the sickness or death of classroom animals. They should have ready access to the address of a nearby veterinary surgeon or a local

branch of an animal welfare agency. Either of these can provide advice when it is needed.

Further information about what should and should not be attempted with regard to keeping living things in the classroom may be obtained from sources such as the following:

- Ontario Animals for Research Act
- Migratory Birds Convention Act of Canada
- Endangered Species Act of Canada
- The Ontario Ministry of Agriculture and Food
- The Ontario Ministry of Natural Resources
- The Ontario Ministry of The Environment

ACKNOWLEDGEMENTS

Project Managers - Bert Stahlke
Ministry of Education

Francine Morissette
Ministry of Education

Project Leader - Les Asselstine
Ministry of Education

Writing Committee

Betty Johnston (O.T.F.)
York Region Board of Education

Georgette Mitchell
Sudbury Board of Education

Bonnie Morrison
Simcoe County Board of Education

Marion Penrose (O.T.F.)
Scarborough Board of Education

Rod Peturson
Windsor Board of Education

Carla Pieterson
London Board of Education

Donna Quigley
Hamilton Board of Education

Lise Savard
University of Ottawa

Pat Willcock
Metropolitan Separate School Board

Advisory Committee

Jack Bell
Ministry of Education

Rick Carter (S.T.A.O.)
Etobicoke Board of Education

Gilles Castonguay
Ottawa Roman Catholic Separate School Board

Ron Cussons
Ministry of Education

Carol Esposti (O.T.F.)
Sault Ste. Marie Board of Education

Grant Evans
Dufferin County Board of Education

Rod Ferguson (C.O.E.O.)
Ottawa Board of Education

John Fowles
Ontario Science Centre

Hazel Hodson-Walker (O.S.T.C.)
York Region Board of Education

Sandra Hughes (O.S.L.A.)
Brant County Board of Education

Mike Johnson (O.T.F.)
London & Middlesex County Roman Catholic
Separate School Board

Paulette Laforest-Norman
Ministry of Education

Rick Lankowski
Waterloo County Roman Catholic
Separate School Board

Richard Lanthier
Prescott & Russell County Roman Catholic
Separate School Board

Constance Legentil (O.T.F.)
Essex County Separate School Board

Micheline Lortie
Kapuskasing District Roman Catholic
Separate School Board

Diane Lozier
North York Board of Education

Norma Luks
York Region Board of Education

Dennis McGowan
Ministry of Education

Muriel McKinley
Ottawa Board of Education

David McLeod (O.A.E.A.O.)
Red Lake Board of Education

Mary Noylander (Retired)
Toronto Board of Education

Doug Paul (S.C.C.A.O.)
North York Board of Education

Jose Richter (C.A.P.E.)
York Region Board of Education

Frank Sebo
Ministry of Education

Shirley Stanton
Ministry of Education

Joe Strever (O.T.F.)
Simcoe County Board of Education

Elizabeth Terry
Ministry of Education

Ruth Vernon
Ontario Educational Communications Authority
(TVOntario)

Elgin Wolfe
University of Toronto

C.A.P.E.	Consultants'/Co-ordinators' Association of Primary Educators
C.O.E.O.	Council of Outdoor Educators of Ontario
O.A.E.A.O.	Ontario Association of Education Adminstrative Officials
O.S.L.A.	Ontario School Library Association
O.S.T.C.	Ontario School Trustees' Council
O.T.F.	Ontario Teachers' Federation
S.C.C.A.O.	Science Co-ordinators' and Consultants' Association of Ontario
S.T.A.O.	Science Teachers' Association of Ontario